

# Radiation and Flying

## 4

### **Starting Point**

Radiation affects us every day. The Sun radiates energy which supports all life on Earth. Light bulbs radiate light energy, microwave ovens radiate energy, you radiate energy, even your food radiates energy!

We can all cope with a bit of radiation. It won't affect us unless we get too much. But doing certain things increases the amount of radiation we get, our radiation dose.

Every time you fly in an aeroplane, you are exposing yourself to radiation. But how much? Is it safe? Are regular flyers risking their health? In this module of Radiation Reporters, it's up to you to find out.

# Task 1



To start off, see if you can find out the recommended *annual radiation dose* that the experts think is safe - look for the **LEGAL WORKER DOSE LIMIT**. It may be measured in *rems, millirems, Sieverts* or *units*. Don't worry too much about this - your science teacher will help you understand what the number means.

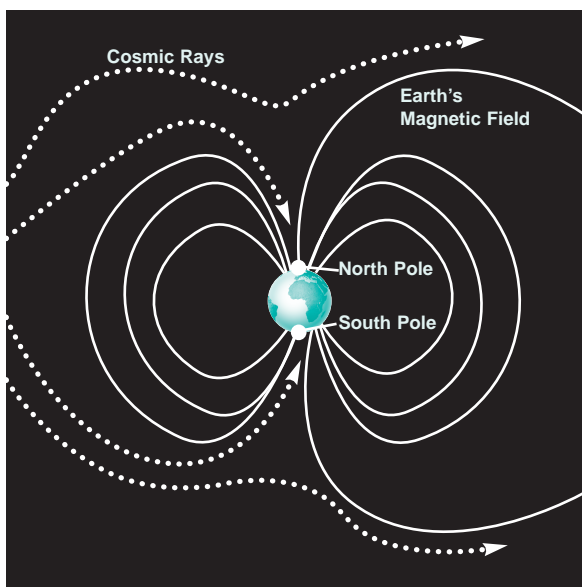
For extra info, you may be able to find the *average annual radiation dose* for someone in the UK. Have a look.

## Cosmic Radiation

Radiation comes from all sorts of places: the Sun, elements like Uranium and rocks in the Earth are some examples.

Radiation also comes through space from other stars. This is called **Cosmic Radiation**. On the ground, we are protected from a lot of it by the Earth's **atmosphere**, but the higher up you go in an aircraft, the less protection you get.

The **Earth's magnetic field** also protects us from Cosmic Radiation. This protection is best near the **Equator** but weaker near the **poles**, as shown in the diagram below.



Most people agree that the more time you spend flying, the more Cosmic Radiation your body will receive. But is there a big enough dose to do you harm?

# Task 2



Find out how much Cosmic Radiation you will get on one flight. Remember to say where it is to and from, or how long it lasts. Compare this with the Legal Worker Dose Limit you found earlier.

Is flying to Spain for your holidays dangerous? Should you be worried about your health, and is there someone else who may be more affected? Write a short passage, using the information you have found out so far, that says what you think.

## Cosmic Radiation is Ionising Radiation

This means that Cosmic Radiation could damage cells in your body if you get too much of it. If cells in your body are damaged in this way, they could **mutate** or become **cancerous**.

## The Debate

The Government, as well as the major airlines and radiation specialists, all have their own view on the effects of Cosmic Radiation in flights. It is up to you to filter out the facts from the opinions, and, using all the information you can, come to a fair scientific **conclusion** about what you have found out.

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- Have scientists always agreed on everything?
- Could scientists or companies, for example airlines, be biased in any way? How?
- What would help you believe a scientist more?

# o p i n i o n

In this section are some quotes from different sources. Use them to help you write your piece of work later.

## Source 1

Cosmic radiation is both a complex and emotive subject. It cannot be seen, touched, smelled or tasted and yet it is present all around us. Whilst we know that there is no level of radiation exposure below which effects do not occur, we can estimate the probability of any harm occurring based on the exposure received. This... reassures us that there is an extremely low probability of individuals suffering an abnormality or disease as a result of exposure to cosmic radiation.

### From the website of British Airways.

[http://www.britishairways.com/travel/healthcosmic/public/en\\_gb](http://www.britishairways.com/travel/healthcosmic/public/en_gb)



## Source 2

### Flying And Radiation Risk

Reported September 2005

NEW YORK (Ivanhoe Broadcast News) - Most careers have an occupational hazard, but frequent fliers may be exposed to cosmic radiation and not even know it. We all know the risks when we fly, but one risk we don't know about comes from what's in the sky. Captain Joyce May, a commercial airline pilot, says, "By the time you're at normal jet cruising altitude of, say, 39,000 feet, the total radiation is about 64-times greater than what it is at sea level."

May fears fellow crew members and frequent business fliers don't know the risk of cosmic radiation from solar flares. She says, "Aircrew members, by-and-large, are unaware of this issue." Robert Barish, Ph.D., physicist and author of "The Invisible Passenger: Radiation Risks For People Who Fly," says, "The Sun is really a big thermo-nuclear device." Barish believes airline crew members are exposing themselves to more radiation than almost any other occupation. He says, "People who work in the nuclear power industry on an average basis are getting 1.6. There are people who fly in airplanes who are getting 2 or 3 or 4 milliSieverts per year. So they are truly radiation workers."

Everyone is exposed to some radiation every day. The Sun constantly emits charged particles that intensify during solar flares. Normally, the Earth's atmosphere absorbs much of this, but at the high altitudes and latitudes airliners fly, crews are subjected to higher radiation levels and possibly are at higher risk for developing cancer. In Europe, it is mandatory flight crews be educated about cosmic radiation, but that's not the case in the United States. The risk is not the same for everyone. Casual fliers have nothing to worry about. Only people who fly at least once or twice a week.

### From the website, Discoveries and Breakthroughs Inside Science.

<http://www.ivanhoe.com/science/>

# o p i n i o n

## Source 3

Increased air travel is responsible for a jump in the amount of natural radiation to which Britons are exposed. The official figures, from the National Radiological Protection Board (NRPB), come as separate research shows that airline pilots have more chance of developing one form of leukaemia. This is blamed on “cosmic radiation” from the Sun, which is more intense at the altitudes reached by modern aircraft.

However, the increased risk of acute myeloid leukaemia was noticed only in pilots who had clocked up more than 5,000 flying hours in their careers. Experts have stressed that even frequent flyers will not accumulate a high dose.

The NRPB’s 1999 radiation dose review reveals that nuclear power workers, on average, now receive a lower annual average dose of radiation than aircrew. Overall, the average exposure of the UK population to radiation has stayed the same, due partly to decreasing exposure to “man-made” radiation.

The average UK dose is 2.6 milliSieverts (mSv), but the highest average was in Cornwall, where naturally-occurring radioactive radon gas raises this to 7.8 mSv. A frequent flyer aloft for around 100 hours a year would receive an additional annual dose of approximately 0.4 mSv.

Dr Michael Clark, a scientific spokesman for the NRPB, said: “It’s surprising how few members of the public are aware of this cosmic radiation. But even frequent flyers get doses that are within the acceptable normal ranges.” The study, published in the *Lancet*, examined Danish male jet cockpit crew flying more than 5,000 hours. The researchers estimated that such crew members receive up to nine mSv a year. Out of 3,877 crew, 169 developed cancer, compared to 153 in a similar-sized sample of non-pilots.

The pilots suffered more cases of skin cancer, but this was explained by the theory that many spent more time than non-pilots in sunny climes. The increase in leukaemia cases was described as “significant” - and the researchers suggested that as airline pilots may be naturally more healthy than the average person, the risk may even have been underestimated. However, they said the increase did not represent a “major effect”.

## Other studies

Four other studies have shown increased cancer mortality in pilots, and one found a higher incidence of breast and bone cancer in female cabin crew who had been flying for more than 15 years. One, involving Air Canada pilots, showed an increase in acute myeloid leukaemia.

However, a study carried out by British Airways showed that its pilots and flight engineers had a reduced risk of dying from cancer. The airline has installed cosmic radiation monitors in its flagship aircraft Concorde, which flies at much higher altitude than conventional aircraft.

Because the flight is far quicker, passengers and crew under normal circumstances would receive a lower dose than on a normal flight, but in times of abnormally high radiation levels, such as during a period of solar flares, the pilot may be warned to reduce height.

As much as 85% of the average annual radiation dose comes from natural sources. Half the “natural” exposure comes from exposure to radioactive radon gas, with the rest from internally produced radiation, small levels of uranium and other radioactive substances in soil and rocks, and cosmic radiation.

“Man-made” sources are mostly medical x-rays and CT scans, with less than one per cent coming from nuclear discharges, fallout from nuclear testing in the 1960s and radioactive paint used on “glow-in-the-dark” watches.

**From the BBC News website, Friday 10th December 1999.**

<http://news.bbc.co.uk/1/hi/health/557340.stm>

# Task 3



Copy out as many **FIGURES** or **STATISTICS** as you can from these 3 sources. Remember to note which source you got which piece of information from.

Next to each, give it a tick if the author said where he or she got that figure from. Give it a question mark if he or she didn't say.

## Your Views

It's time for you to put together your own piece of work on what you think about Radiation and Flying.



# Main Task



Write an essay on **Radiation and Flying: the Effects of Cosmic Radiation.**

Do an **Introduction**, describing **Cosmic Radiation** and who it might affect.

Compare what different people say, any facts and figures you have found and whether they agree or not.

Write about people's opinions, and whether you think they are backed up by the facts.

Do a **Conclusion** to finish the essay, pulling it all together and offering your own opinion on who is affected and how safe it is, based on what you have learned.

Take your time to look at the 3 articles in the previous section. They will tell you a lot; but there is much more than this, so don't forget to go looking for yourself.

## More Sources of Information

Try these places for more info:

**Google key phrases:** Radiation and Flying, Cosmic Radiation, Radiation in Airplanes.

**National Radiological Protection Board,**  
[www.hpa.org.uk/radiation](http://www.hpa.org.uk/radiation)

**Task 1**

What is the Legal Worker Dose Limit in the UK?

What is the average annual radiation dose for a person in the UK?

**Task 2**

How much Cosmic Radiation do you get from a certain flight?  
(Remember to say which flight, or how long it lasts!)

**Task 3**

Figures and Statistics from the 3 articles

Article	Figure/Statistic	Source mentioned ✓ or ?